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Institute of Plant Industry  
INDORE,  
Central India.

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PROGRESS REPORT  
for the Year Ending 30th June 1932.

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EXAMINER PRESS, BOMBAY.

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# INSTITUTE OF PLANT INDUSTRY, INDORE.

PROGRESS REPORT FOR THE YEAR ENDING  
JUNE 30TH 1932.

## 1. Introduction.—

The Institute of Plant Industry is a Society registered under the Holkar State Societies Registration Act and its primary objects are :—

- (a) The investigation of all matters relating to the production and improvement of raw cotton in India.
- (b) The agricultural development of the Indian States which are members of the Society.
- (c) The training of officers and cultivators nominated by such States.
- (d) The training of advanced students nominated by the Indian Central Cotton Committee.

Its funds are derived entirely from subscriptions. The Indian Central Cotton Committee has made annual grants varying from Rs. 85,000 to Rs. 1,15,000 and the member-States of Central India and Rajputana subscribe another Rs. 47,000 yearly. The Cotton Committee is, naturally, most closely interested with the fulfilment of objects (a) and (d) and, in fact, has spent more upon the Institute than upon any other of the schemes which they have supported; their total annual subscriptions now amount to Rs. 7,46,000 and their donations for capital outlay to Rs. 2,83,500. Their special interest, however, has not led to unconcern for the other side of the work and it is fully realized that each is complementary to the other and in no sense antagonistic.

The Governing Body of the Institute is representative of the Cotton Committee and the member-States and its President is the Agent to the Governor-General in Central India, *ex officio*. The Director of the Institute is also Agricultural Adviser to States in Central India and Rajputana, and in addition represents all those States upon the Indian Central Cotton Committee.

This constitution has proved itself admirably suited to the needs of a research station and centre for agricultural development: administration is made smooth and efficient, while financial control and purity is ensured through detailed budget estimates and quarterly audits by a firm of Chartered Accountants. The elasticity of a commercial undertaking is thus gained in large measure with a great resultant increase in efficiency.

## 2. Meetings, General and Board of Governors.

A General Meeting of the Society was held at the Institute on Feb. 11th 1932. Several Rules and Regulations were amended to suit changed conditions, notably with regard to representation on the Board of Governors. The Board was increased from 7 to 11 members and an electoral principle for the representation of the States was laid down. The Board of Governors met on the following day.

### 3. States contributing as Members of the Institute.

At the closing date of this report the following nineteen States in Central India and Rajputana were members of the Institute, arranged in order of joining.

Indore  
*Dhar*  
 Jaora  
 Datia  
 Rutlam  
 Dewas, Senior Branch  
 Sitaman  
 Narsingarh  
 Tonk  
 Bijawar  
 Barwani  
 Jhalawar  
 Bikaner  
 Rewa  
 Jaipur  
 Bundi  
 Partabgarh  
 Orchha  
 Bharatpur

The Thakur of Bagli, a Guaranteed Thakur of Gwalior is also a member.

A number of other important States are contemplating joining but the existing financial stringency in all quarters causes much hesitation over any new expenditure, however desirable.

### 4. Staff and Students.

The Directorship of the Institute, vacant through the retirement of Mr. Albert Howard, C.I.E., M.A., had been filled by the appointment of Mr. F. Keith Jackson, N.D.A. (Hons.), Dip. Ag. (Camb.), formerly Director of Research in the Department of Agriculture, Iraq, who took up his duties on July 21st, 1931.

Two new posts have been sanctioned by the Board of Governors, one for a thoroughly well qualified Geneticist and Botanist, in order that research work, especially on cotton, may be expanded, the other for an Extension Officer to devote his whole energies to the development of agriculture in the contributing States.

The Indian Central Cotton Committee, having awarded a Scholarship of Rs. 100 per month for research training in Plant Breeding and Cytology, posted the holder to the Institute for the year under report.

The Irwin Scholarship fund (Rs. 4,000) donated to the Institute in July 29th 1928 by Sir Sarupchandji Hukamchand was exhausted during the year.

From Institute funds four Research Studentships carrying honoraria of Rs. 50 per month were created to enable young men of good qualification to obtain training in research work, preference being given to those nominated by, or associated with, the contributing States. These studentships are proving of advantage both to the Institute and the holders.

### 5. Visitors.

The following list of visitors during the year indicates the wide interest taken in the Institute, not only by its direct supporters but by others:—

Apji Amarsingh of Koela, Kotah State, Rajputana.

Rai Sahib R. L. Batra, P.C.S., B.A., LL.B., Revenue Member. Bharatpur.

Seth Bhanwar Lal Sethi of Messrs. Binod Ram Balchand, Bankers, Indore.

Raj Kumar Chatterji, Esqr., B.A., Bar-at-law, Dewan, Banswara State, Rajputana.

F. C. Coventry, Esqr., Dewan, Partabgarh State, Rajputana.

R. M. Crofton, Esq., I.C.S., Excise Commissioner, Central India. Indore.

Rao Bahadur Col. Thakur Devising of Chitora, Jaipur State, Rajputana.

Major M. V. Deolekar, Private Secretary to H. H. The Maharaja of Dewas, S.B., Central India.

G. T. Dyer, Esqr., C.I.E., I.C.S., Revenue Member & President of Council, Bhopal State, C.I.

Sir Reginald Glancy, K.C.I.E., C.S.I., Member. Indian States Inquiry Committee.

Duncan Hall, Esqr., Secretary, League of Nations, Geneva, Switzerland.

Rao Bahadur H. M. Gosalia, M.A., LL.B., Dewan & President, State Council, Barwani, C.I.

Munshi Himmat Singh, K. Maheshwari, M. A., Revenue Member, Jodhpur State, Rajputana.

Major-General Sir Robert Hutchinson, K.C.M.G., C.B., D.S.O., M.P., Member, Indian States Inquiry Committee.

Sahibzada Ismail Ali Khan of Tonk State, Rajputana.

Apji Kalyansingh of Koela, Kotah State, Rajputana.

Rao Sahib N. A. Kathavate, B.A., Member of Council, Narsingarh State, C. I.

Sir Joseph A. Kay, Vice-President, Indian Central Cotton Committee, Bombay.

Dr. B. A. Keen, Director, Imperial Institute of Agricultural Research,  
Pusa, Bihar, and Assistant Director, Rothamsted Experimental  
Station, England.

Mr. P. J. Patrick, Secretary, Indian States Inquiry Committee.

Maharaj Kumar Lokendra Singh of Manipur State, Assam.

Knmars of the Daly College, Indore, C. I.

Kumars of the Mayo College, Ajmer, Rajputana.

His Highness the Maharawat of Partabgarh, Rajputana.

Rao Bahadur Mansingh of Barwara, Jaipur State, Rajputana.

Lala Mulk Raj, Chief Revenue Offi     Dhar State, C. I.

Sahibzada Mahmud Ali Khan, Dewan, Baoni State, C. I.

Pandit Nand Kishore Chaturvedi, M.A., LL.B., Deputy Commissioner.  
Rewa State. C.I.

Dewan Bahadur Sardar Pandit Narayan Prasad of Dewas State (Senior)  
C. I.

Raja Bahadur Narindra Singh, Heir-Apparent, Panua State, C.I.

N. Lal Singh, Esq., Chief Revenue Officer, Sitaman State, C.I.

The Hon'ble Lieut.-Col. G. D. Ogilvie, C.S.I., C.I.E., Agent to the  
Governor-General in C. I. Indore.

K. Raghubir Singh. B.A., Guardian—Tutor to H. H. The Rana of  
Barwani, C. I.

J. H. Ritchie, Esq., M.A., B.Sc., L.A.S., Secretary, Indian Central Cotton  
Committee, Bombay.

Sir James Roberts. K.C.I.E., I.M.S., (Retd.)

Khan Bahadur Sahibzada Sarfraz Ali Khan, Chief Secretary, Jaora  
State, C.I.

Rao Bahadur Sahasrebnidhe, M.Sc., Agricultural Chemist to Government,  
Bombay.

Thakur Sajjan Singh of Bagli, Gwalior State.

Khan Bahadur Syed Shaukat Ali, B.A., Dewan, Rajgarh State, C.I.

E. F. Sykes, Esq., Member, Legislative Assembly, Delhi; Bundi Agri-  
cultural Syndicate, Bundi State, Rajputana.

Rao Sahib B. P. Vaghalker, Deputy-Director of Agriculture, Poona,

S.C.D. Khan Bahadur D. F. Vakil, B.A., Dewan, Rutlam State, C.I.

Dewan Bahadur Sir T. Vijayaraghavacharya, K.B.E., Vice-President,  
Imperial Council of Agricultural Research, Delhi.

The Heir-Apparent of Khilehipur State, C.I.

## 6. Library.

The Library continues to grow in usefulness, over 500 additions having been made during the year. It now contains nearly 3,500 text-books, reference books and volumes of periodicals, an author-catalogue of which has been prepared. Subject-indexing and binding of the whole library is proceeding. Presentations include a large quantity of reprints and memoirs from Mr. A. Howard, C.I.E., M.A., the late Director of the Institute and, from the Imperial Institute, London, a set of its *Bulletins* from 1903 to date.

Over 200 books were sold during the year and 790 remain in stock.

## RESEARCH WORK.

### 7. Organization.

Some separation of agricultural research into subjects is necessary for clarity but this should not cloud the fact that most "subjects" are closely intermeshed with each other in the general economy of agriculture. It is impossible, for example, to study fully a crop such as cotton without touching other "subjects" whether they be other crops or "separate sciences."

The growth of knowledge of agricultural science has been so rapid and has already reached such a huge sum total that some system of specialisation has been inevitable as well in academic education and training as in research work. No one man could possibly examine all sides of a problem intensively. A great danger lies in this—the development, probably unconsciously, of a series of water-tight compartments, (Chemistry, Physics, Plant Breeding, Entomology, Mycology, etc.), ignoring the essential inter-dependance and inter-actions of the phenomena dealt with in these water-tight compartments. The cynical yet apt definition of a specialist as "one who knows more and more about less and less" is a warning against this danger. In the absence of a supply of research workers possessing a degree of omniscience not usually found in mankind, the best hope of solving agricultural problems seems to lie in concerting the efforts of several workers, each approaching the objective at his own angle, yet being aware of his fellows' advances and routes. It is hoped more and more to apply this strategic system to the research work at the Institute.

### 8. Weather and its effects on crops.

The monsoon broke on June 13th 1931 and resulted in a total rainfall at Indore of 42.8 inches, the annual average being a little over 30 inches. From June 27th to September 6th, 73 days, rain fell on 62 days, the dry intervals being all of one day only except for a single four-day dry period. After a dry spell of 12 days there were 25 days of rainfall during a second period of 29 days. The rainfall was thus abnormally continuous; even the surface soil had no chance to dry out and the resultant excessive compacting, leaching and development of the typical colloidal "blanket",



impervious to air, was disastrous to cotton especially on the heavier types of the black cotton soil of the Malwa plateau. Other crops suffered more or less according to the ability of their root systems to withstand the conditions. On light land and especially in Rajputana rainfall and crops were more normal, though a downpour in October did harm. The winter was mild with subnormal rainfall, which reduced yields of *rabi* crops.

## 9. Cotton.

- (i) Improvement of variety.
- (ii) Physiology.

(i) The creation of a pure and improved *barani* (rain-fed) cotton for the Malwa plateau is an important part of the programme. In 1931 for the first time a replicated-plot yield test was laid down for ten of the pure-line selections of Malvi cotton (*G. neglectum Malvensis*), indigenous on the plateau. The selections had been made mainly for lint-length and ginning percentage and yield had not previously been tested. There was scarcely any significant difference in yield between any of the selections and the "control" which was a mass-selected Malvi mixture containing very few Roseum or other impurities. The lay-out design of this test, however, was not ideal and the results must be accepted with caution but it is satisfactory that the improvement achieved in staple and quality does not appear to have reduced the yielding capacity. Samples of these selections and the control have been sent to the Indian Central Cotton Committee's Technological Laboratory, Matunga for examination.

The question of a variety for well-irrigated land in Malwa does not seem likely to be solved by selection among *Malvensis* types which do not give such response to irrigation and intensive cultivation as do American cottons such as Cambodia. This is unfortunate as it involves, at present, two varieties being grown in the same area and the Americans are specially susceptible to injury from the deterioration of the black soils during the rains. Some Cambodia selections made at Indore are under examination, these show degrees of resistance to such injury.

A number of varieties of cotton for Rajputana were tried in single plots in Jaipur, Bikaner\*, Bharatpur and Jhalawar States to gain information on general behaviour in those soils and climates.

The Botanical survey of cottons grown in India was continued and the examination of root-systems of the varieties on hand was completed. Seed of further varieties and strains has been obtained from various Agricultural Departments, bringing the total collection up to 98.

A new piece of research work was begun in the autumn of 1931—The effects of X-radiation of cotton seed, buds and pollen upon subsequent generations. Remarkable mutations have been obtained by other

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\* Under the Gang Canal Colony cotton improvement scheme for which a special grant is made by the Indian Central Cotton Committee.

workers, in cotton and other plants but little seems to have been done with a direct economic aim. A number of exposures were made at the King Edward Hospital, Indore by the courtesy of its Director. Irradiated material has also been prepared for cytological examination.

(ii) Under the heading: **Physiology** most of the work has been done upon the relationship and reaction of the cotton plant to its environment in the black soils of Malwa plateau. In particular the soil and roots have been studied in relation to healthy and unhealthy Cambodia cotton plants, many root-exposures having also been drawn to scale from plants at different stages of growth. The connection between the unhealthy conditions "leaf-roll" and "red-leaf" and the deterioration of black soils during the rains had been established previously. A replicated-plot experiment was laid down in 1931 to discover the effects on yield, on the health of the plant and on the soil, of various correctives. A specially sensitive strain of Cambodia and a mixture of six pure Malvi strains were used. The nature of sap differences in healthy and unhealthy Cambodia plants were also examined. A paper has been prepared for publication, embodying the results of much of the work mentioned above, as well as that done in the past three years.

Although this investigation has been upon the relations between cotton and soil condition the results of course apply in the case of other crops in greater or less degree.

#### 10. Sugar-Cane.

Past work on this crop was confined to the annual growth of a small area of S. 48 variety, the cultivation being on the lines of that practised in Java. S. 48 is now rapidly displacing local varieties in Central India, wherever it has been introduced by the Institute.

No tests of other varieties were made until 1932 when a replicated randomized group experiment was planted with five varieties (S. 48, Co. 210, Co.213, Co.281 and Co.290) at Indore, and another similar trial of five varieties (S.48, Co.213, Co.244, Co.281 and Co. 290) on the Narsingarh State Farm, with the willing co-operation of the Darbar. An examination of cultural methods has also been begun.

The relative merits of the McGlashan, Rohilkhand and *desi gur*-boiling furnaces were thoroughly tested and the economy in fuel and labour of the first-named was proved, the resultant *gur* being in no way inferior to that made on the Rohilkhand system and superior to the *desi* product.

#### 11. Wheat.

Wheat is grown in Malwa both irrigated (on a relatively small area) and as a rain-fed crop. In area and value it is far the most important of the rabi crops and is one of the two staple cereals, jwar being the other. The type grown without irrigation is almost always a *durum* or "macaroni" wheat and it commands a premium price, both for export to other parts of India and for local consumption, over *vulgare* wheat such as *Pissi*, which is also grown in a few parts. It is usually very pure.

In the *rabi* season of 1931, two replicated, randomized, strip experiments were laid down, with the object of finding the relative yields of six standard varieties\* and the Malvi *durum*, under rain-fed conditions. There were only slightly significant differences in yield between any of the standard varieties but several of them were definitely superior to Malvi, notably Pusa 100 and Pusa 101.

Some *durum* and *vulgare* varieties from Egypt, Iraq, Palestine, Russia, and Australia, were grown in single lines for preliminary test, and types were isolated from bulk seed from different localities in Central India and Rajputana.

## 12. Gram.

This probably comes next to wheat in importance as a *rabi* crop. Small quantities of some 20 varieties, which had been isolated at Pusa, were tested in lines, and the most promising will be taken forward to larger scale trials next *rabi* season.

## 13. Linseed.

In many parts of Central India this is a very important *rabi* crop and selection work has been begun on local seed and among types already isolated at Pusa.

## 14. Other Crops.

Initial trials of several varieties of lucerne, soya bean, berseem, Sudan grass and barley were made.

## 15. Agronomy.

The deterioration of the black cotton soils through continuous rain already referred to is often a factor responsible for very great reductions in yield of cotton and other crops†. To find a method of arresting this deterioration, which the cultivator would be able to adopt, is therefore a quest of prime importance. One method is to raise the soil-content of organic matter by adding farm-yard manure, but the quantity produced on an average cultivator's holding in Malwa is insufficient for more than his limited irrigated area. He cannot afford to buy other organic manures such as oil-cakes and if he could the supply would not be equal to the demand. Green manuring is a possibility but the land must then lie fallow and useless while the ploughed-in crop is rotting, and though the practice is known it is little used in Malwa.

An increase in the production of farm-yard manure on the holding presents the easiest solution to the problem and the technique of the "Indore compost process."‡ worked out at the Institute during the last three years provides the means without cost other than the cultivators' labour. By utilizing various farm wastes and without precluding the

\* Pusa 4, 12, 52, 100, 101 and C. P. 115.

† 1931 the yield of the cotton crop per acre in Malwa was generally estimated at 50% below normal due to this cause.

‡ "The Waste Products of Agriculture, their Utilization as Humus". A. Howard, O.L.E., M.A., and Y. D. Wad, M.Sc. (Oxford University Press), gives a description of the process in simple terms and an account of the experimental work leading up to it. The book may be obtained from the Institute, price Rs. 5/-.

traditional and almost inevitable use of cowdung cakes as fuel the production of manure from any holding can be doubled or even trebled. The product is superior to most farm-yard manure in respect of nitrogen-content, its availability and in the almost complete reduction of the waste materials to a stage which makes no call on soil nitrates to bring about further rotting. The process is already being actively adopted by large cultivators, and States are demonstrating its advantages in villages and on State farms.

## PROPAGANDA AND EXTENSION WORK IN STATES.

### 16. Requirements.

Any improvement in method or crop-variety resulting from experimental work is of no utility until it is adopted by the cultivator as part of his normal practice. His financial resources and his general outlook impose serious limitations upon the sort of improvements he is able and willing to adopt and these limitations must always be kept in mind. To advocate something quite outside his reach is actually to do harm, as it impairs his confidence and destroys his interest.

Actual contact with cultivators on their land obviously cannot be maintained on any large scale by the Institute—that is, and must be, a function of the State Governments. The Institute's part is to supply information, to advocate and advise, and to encourage and assist the States in every possible way.

This type of assistance can best be given by personal visits to States. During the year 33 such visits, have been made by the Agricultural Adviser and 25 by the staff of the Institute, including the newly-appointed Extension Officer.

### 17. Instructional and training facilities.

**States' officials and students.** A number of junior or prospective agricultural employes of States have been received for periods of from one to nine months at the Institute and given general practical training. Some have come specially to learn the Indore compost process and for this *malis* and ploughmen have also been sent.

In addition a special 17-days **Course for Revenue Officials** was held in October 1931 which 20 attended. The programme of agricultural development was explained in detail by lectures and demonstrations and the enthusiastic interest shown left no doubt that Revenue Staffs can render much service by spreading information and giving friendly advice during the course of their own duties. The course received general commendation and will be held regularly in future.

The **Cultivators' Meeting** which had been an annual feature, was held on a somewhat diminished scale, owing to general financial stringency, February 1932, when about 150 cultivators, including many patels attended at Indore for 2 days, coming from seven States. Demonstrations were given to small parties at a time and in the evenings agricultural cinematograph films were shown. The scheme for a permanent camp for cultivators remains in abeyance, pending better times.

**Agricultural Shows and Cattle Fairs** were supported in 5 States ; staff, exhibits, and cinematograph displays being provided by the Institute and demonstrations arranged of sugar-cane cultivation, *kans* eradication, silage making, the Indore compost process, etc. A cinematograph camera and projector has been bought so that appropriate films can be prepared.

**Leaflets** have been issued in English and Hindu upon lucerne cultivation and the Indore compost process (1000 copies of these two were asked for and issued) and circular letters to States drew attention to desirable activities from time to time.

**Special demonstrations** were arranged by request in several States of the construction and use of the McGlashan *gur*-boiling furnace. Trained workers have been lent to demonstrate the Indore compost process and train others.

#### 18. Provision of seed, implements, etc.

Before each sowing season every member-State was addressed, inviting the purchase for general distribution or trial of various pure seeds of proved varieties. Wheat, sugar-cane, lucerne, ground-nut, cotton (Cambodia and mass-selected Malvi) and some less important crops have been so distributed.

**Sales of implements**—*Kans* eradicating ploughs, "Indore ridgers," 2-row drills and levelling scoops have declined considerably during the year as was to be expected. A stock of "Burdizzo" castrating instruments is now maintained and their use is constantly advocated so as to eliminate the use of inferior bulls. Many of the contributing States now employ these instruments.

#### 19. Special enquiries.

Advice was sought upon the layout and working system for a sewage farm to deal with the effluent from the Jaipur City sewage works. A detailed scheme and report were provided.

Operation and experimental schemes were drawn up for States. Demonstration and Experimental Farms in seven States and special field experiments have also been arranged and laid out on private lands in three States with the willing co-operation of the occupiers.

Other special advice has been asked for, both by States and cultivators, upon particular problems and in several cases injudicious expenditure of capital was thereby averted.

By such means as the foregoing constant endeavour is made to maintain close relations with all contributing States and so to develop an atmosphere of confidence. Encouraging success has been achieved in this aim and, in spite of extreme financial difficulties in some States, not one has withdrawn from membership of the Institute.

F. KEITH JACKSON,

Director.

## STAFF AND STUDENTS OF THE INSTITUTE OF PLANT INDUSTRY.

INDORE, ON JUNE 30TH, 1932.

Director	.. ..	F. Keith Jackson, N.D.A. (Hons.), Dip. Ag. (Camb.)
Personal Assistant	.. ..	A. N. Srivastava, M.Sc.
Head Clerk & Acct.	.. ..	M. A. Shakoor, B.Com.
2nd Clerk	.. ..	Har Prasad
Artist	.. ..	S. R. Srinivasan Ayyar
Librarian	.. ..	Bashirhusain Khan
Geneticist & Botanist	.. ..	Vacant.
Senior Botanical Asstt.	.. ..	Vacant.
Plant Breeding Asstt.	.. ..	Kuber Singh, B. Ag.
Botanical Asstt.	.. ..	R. L. M. Ghose, M.Sc.
Research student (I.C.C.C.)	.. ..	Bhola Nath, M.Sc.
„ „ „	.. ..	S. R. Swarup, B.Sc. (Ag.)
Chief Asstt. in Chemistry	.. ..	Y. D. Wad, M.A., M.Sc., A.I.I.Sc.
Chemical Assistant	.. ..	V. G. Panse, B.Sc.
Research Student	.. ..	Chironji Lal Nagar, B.Sc. (Ag.)
„ „	.. ..	V. N. Bhargave, B.Sc.
„ „	.. ..	R. K. Aurangabadkar, M.Sc.
Senior Farm Asstt.	.. ..	G. C. Tambe, B.Ag.
Farm Assistant	.. ..	S. C. Talesara, B. Ag.
Junior Farm Asstt.	.. ..	G. G. Phadke, L.Ag.
„ „	.. ..	K. M. Simlote, B.Ag.
Fieldman	.. ..	Nihal Singh
„	.. ..	V. R. Sathe
„	.. ..	E. L. Rajana
Store Keeper	.. ..	Ishri Prasad
Extension Officer	.. ..	M. L. Saksena, L.Ag., F.I.S.C.